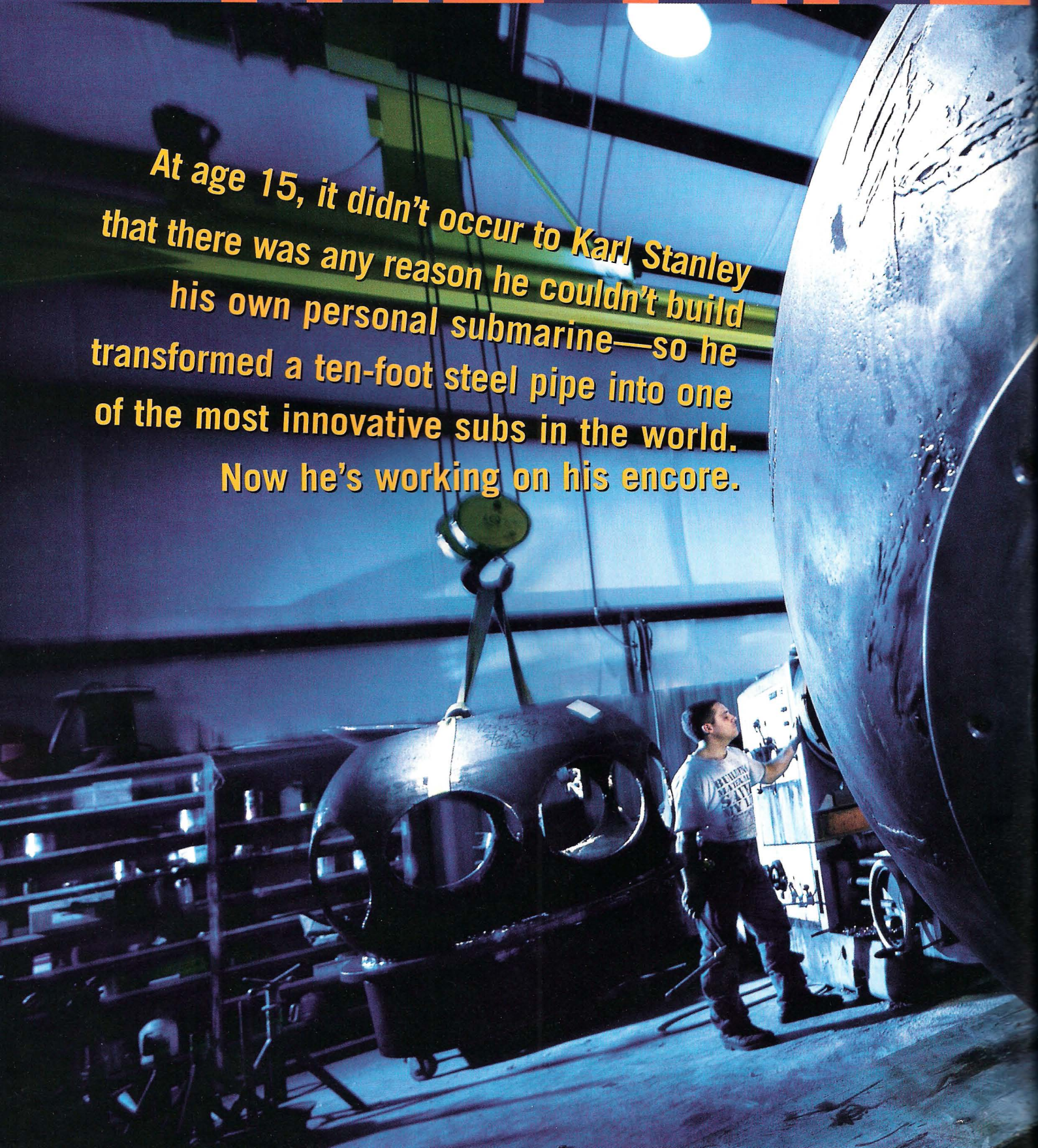


# THE PIPE

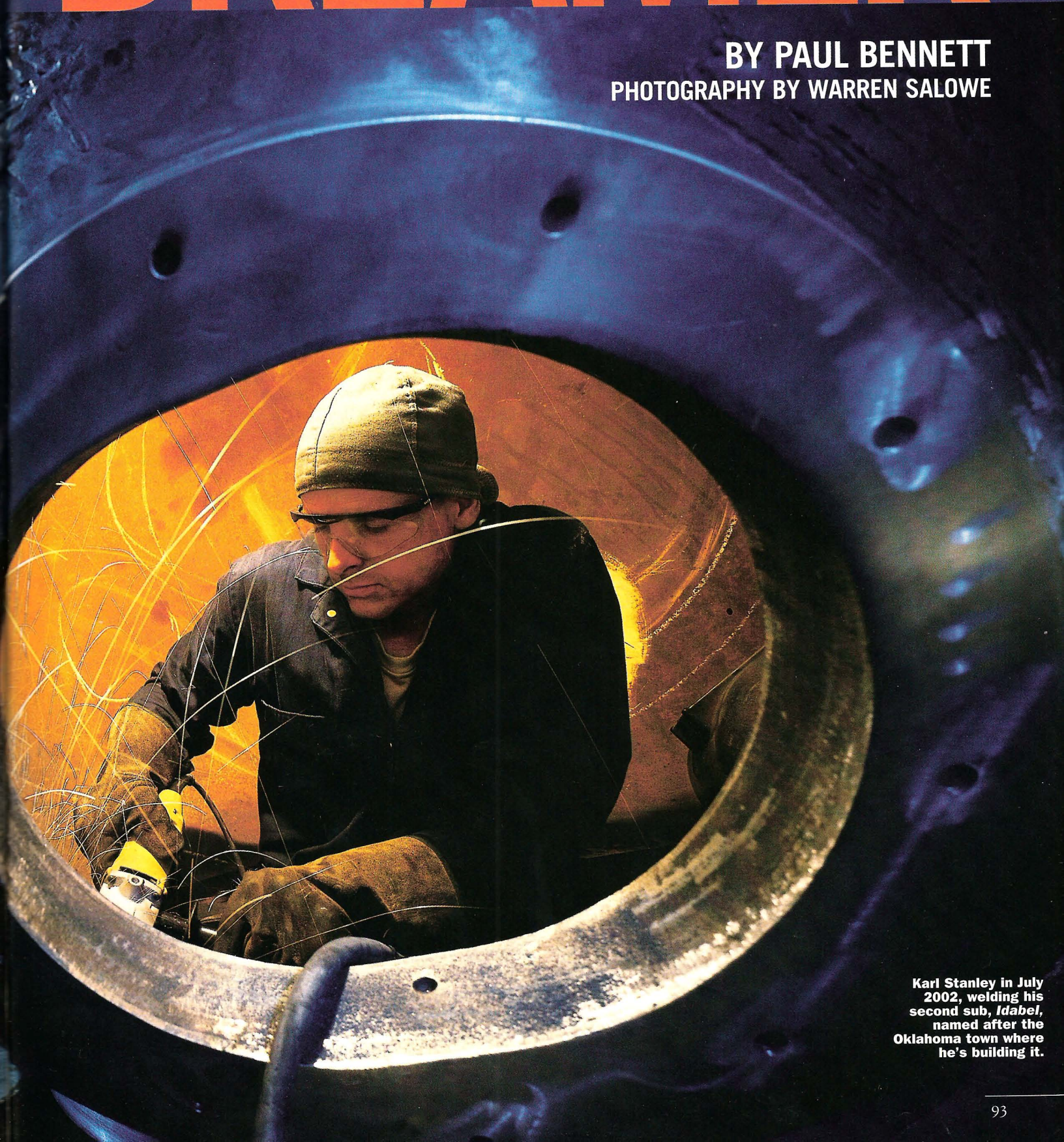
At age 15, it didn't occur to Karl Stanley that there was any reason he couldn't build his own personal submarine—so he transformed a ten-foot steel pipe into one of the most innovative subs in the world. Now he's working on his encore.





# DREAMER

BY PAUL BENNETT  
PHOTOGRAPHY BY WARREN SALOWE



Karl Stanley in July 2002, welding his second sub, *Idabel*, named after the Oklahoma town where he's building it.



HE YELLOW SUBMARINE squeaks as it spirals downward: 100 . . . 200 . . . 360 feet. It wavers in the current off the island of Roatán, Honduras. Inside sits Karl Stanley—young, skinny, transfixed on the task at hand.

He is trying to maneuver a grappling hook into a hole in a sunken 27-foot runabout. The trick is to snag the hook and then pull back sharply to set it, leaving the shipwreck tethered by 400 feet of nylon rope to a surface boat that can then hoist it to daylight. But the runabout, after lying on this ledge for seven years, is almost entirely submerged in silt; the hook won't hold. Stanley and his copilot—a bleary-eyed and nervous Honduran named Alejo Monterossa who's found it impossible to acclimatize to life at 360 feet inside a ten-foot steel pipe—have been at this for some

**A boy and his dream:**  
Stanley and C-BUG,  
near Marathon,  
Florida, July 2001.



eight hours. It's getting late. After seven dives today, the air tanks that provide the lift the sub will need to resurface are running perilously low.

Stanley angles the sub down and drives the grappling hook into a dark orifice of the boat. It grabs. It gives. He thrusts again. It grabs again. He pulls back; it pulls free. Here in the waters off Roatán, there's light even at 360 feet; you can sometimes see the surface, shimmering above. But by four in the afternoon, the underworld begins to recede into shadow. "We better give up for now," Stanley announces at 5:30. "We'll try again tomorrow." He opens the ballast valve. With a hiss, the sub begins to rise.

The trouble occurs at around 230 feet, where the sub halts, momentum tossing Stanley and Monterossa forward against the Plexiglas portholes. Stanley, puzzled, cracks open the ballast valve a bit more, sending a blast of compressed air into the hollow wings on either side of the sub. The entire structure groans with the increased buoyancy, but nothing happens. Then he sees the problem: The nylon line hanging from the grappling hook is taut and angled downward—caught on something below. And the sub doesn't have enough lift to jar it loose.

Stanley carries seven tanks of compressed air on his sub. Six, attached to the ballast tanks inside each wing, were full this morning when he began diving. Now they are so low that if Stanley descends to unhook the line, there won't be enough compressed air to refill the ballast tanks for the final ascent. The seventh tank sits inside the sub and, along with three plastic tubs of carbon dioxide-eating Sodasorb, constitutes the sub's life-support system. If Stanley and Monterossa keep calm and don't hyperventilate, they can stay down for three days.

Stanley knows this, and he knows that the crewmen on the surface boat floating 230 feet above are likely to find some way to dislodge him long before that. But that doesn't keep his mind from considering some dire scenarios; he has, after all, spent the day hovering over a boat that no one has seen in seven years.

They wait in the darkness, flashing the outside light every couple of minutes and catching glimpses of a barracuda circling the sub. Half an hour passes; nothing. And then, like an apparition, the depth gauge begins to move. The submarine appears to be rising.

The story, it turns out, is another in a series of tales of Stanley's charmed life at depth: The surface crew finally noticed the delay and gave the rope a yank, jarring them free; an hour after the sub first jerked to a halt, he and Monterossa were again breathing fresh air.

Many months after this episode, Stanley and I were sitting in the relative comfort of a tourist bar in Havana, swapping stories. On this one, something seemed to hang him up a bit; he got to the rescue, then paused and circled back around to those eerie images from his first moments in limbo. "You have to imagine," he said slowly. "The sub could have hung there for months, if not years, until some small leak finally managed to flood it and it sank to the bottom, all the while having us inside, heavy into the process of decomposing." The way he lingered over the thought, it was as if he was savoring some exotic new flavor—exploring for the first time, at age 28, the idea of failure.

**K**arl Stanley was the kid who made your mother nervous. It wasn't so much what he did as the spirit with which he did it. He once broke into the police station in suburban Ridgewood, New Jersey, to destroy all the parking tickets, because the local legislature had passed a parking restriction aimed at teenagers. He climbed thousand-foot power-line towers. He swam in rip currents. He rode freight trains across half the country. He basically did whatever he wanted to do without ever suspecting that



there might be any reason he shouldn't, or couldn't—he tromped around on that thin bridge that links and divides delinquency and inspiration. And when he was 14, his parents, apparently unable to see a distinction between the two, sent the little troublemaker off to reform school in the middle of the Maine woods.

Trying to escape was futile. Everyone's shoelaces were confiscated on arrival—and the nearest town was 25 miles away. "If you made it there, they'd just show up the next day and find you," Stanley says. So he settled on an alternate scheme: He stopped showering. He would wake in the middle of the night to scream for minutes at a time. Finally, he succeeded in getting himself kicked out.

Instead of bringing him home, though, his parents transferred him to a New Jersey state mental hospital. "It was awful," he says. "There were 20 people on that floor, and I think only one was actually crazy."

After six weeks, though, the doctors were unable to deliver a diagnosis, and Stanley was brought home. And now he poured all of his assurance and focus into a single idea: He would build his own submarine. This wasn't a new passion; at age 11, he'd tracked down Doug Privitt, an amateur submariner who had built five subs, to pick his brain. Now he prevailed upon his parents to buy him some welding tools. "They figured that if I didn't build the sub, the welding itself would be worthwhile," he says. "At least I would learn a decent skill."

He bought a ten-foot section of quarter-inch-thick steel pipe and had it delivered to his parents' home, where he and a crew of his ice-cream-shop co-workers rolled it off the flatbed using an elaborate sling of dog leashes. Stanley is no engineer, not even one of those mechanical savants who make their mark in shop class; he was simply creative and resourceful. He culled design ideas from magazine articles, television documentaries, museum displays, and the diagrams in R. Frank Busby's *Manned Submersibles*, which he still considers the bible of DIY submarining. Another book he found described the efforts of the U.S. Navy to develop an engineless gliding sub. He borrowed the idea and began working up his own sketches.

"It was all pretty simple," he says with a sort of trademark understatement that could as easily be hubris as humility. "I mean, I knew it had to be cylindrical. And it had to be strong."

After three years of flinging sparks all over the lawn, Stanley left for Eckerd College in St. Petersburg, Florida. The "pipe in the backyard,"



After diving for shells, Stanley returns to *SearchStar*, a sub-tender boat he uses to launch and retrieve C-BUG.

ballast tanks on either side, a design he hoped would give the sub a hydrodynamic shape and allow it to glide through water with little—or no—mechanical propulsion. With this in mind, he left out the engine. The whole thing weighed 2,400 pounds and was finished off with a snappy coat of yellow epoxy.

To move the sub forward, the pilot varies the air and water levels in the ballast tanks to nose the craft up or down during an ascent or a dive. The sub's cylindrical shape causes it to torpedo through the water, while the wings keep the cylinder stabilized. Without the whirring of engines, the sub is perfectly quiet. It's also light, since it has to carry neither diesel fuel nor extensive battery banks. (Eventually Stanley would add two trolling motors and a 12-volt battery to help the sub maneuver through tight spaces.) He christened his sub with an appropriately highfalutin name: *Controlled by Buoyancy Underwater Glider—C-BUG* for short.

The week of graduation, roughly a hundred people gathered at a little creek near the college. Among them were reporters from the local TV station and newspaper and 20 safety divers who stood at the

**"IT WAS ALL PRETTY SIMPLE," he says. "I mean, I knew it had to be cylindrical. AND IT HAD TO BE STRONG."**

as his parents called it, still wasn't finished, and for three years he shelved the project. Junior year, though, he learned of a program that paired students with local retired professionals—they'd just finished building a small plane—and so he arrived on campus the next fall pulling his sub strapped to an army surplus trailer. His project quickly attracted a half dozen retired engineers, including several ex-Navy officers. "They were pretty excited," says Stanley, "but no one ever ran any of the numbers to determine structural stability or anything like that. They all just nodded and said it looked pretty strong."

He finished the sub just in time for graduation. The pipe formed the main compartment and was just large enough for the legs and torsos of two passengers. Two towers fitted with Plexiglas portholes accommodated their heads. Steel ribs were added every 18 inches to reinforce the pipe, and its ends were capped with steel hemispheres. Stanley also attached two steel wings that frame the

ready. The sub, on its trailer, was perched over the creek. Stanley climbed in, sealed the hatch, and signaled to be released into the water. The sub dropped five feet, then ten, and then, at a depth of 12 feet, it settled at the bottom of the creek. The first test was a success.

Subs built by professional shipyards go through rigorous lab tests in pressure chambers before they are launched. Besides pinpointing design flaws, the tests establish a maximum depth capability—the pressure at which the design or materials begin to fail. But such tests cost at least \$8,000, and just as Stanley built his craft based on educated guesses, he now chose to test it through trial and error, with himself as the guinea pig. Not every test dive was as successful as the first—windows leaked, gaskets broke. Once, a pair of PVC outriggers imploded, making a horrifying crack that to Stanley sounded a lot like the sub's steel skin collapsing. By



the next summer, Stanley had gone down to 90 feet, as deep as he could in the Gulf waters just off Tampa.

To find deeper water, Stanley crossed the state and began diving in the Atlantic, where he ultimately got down as far as 670 feet. Here, though, he had to have the sub towed out to the edge of the Continental Shelf, which lies about three miles off the coast, far from any reef and on the verge of the tumultuous Gulf Stream current. Other than the occasional tuna or shark, there wasn't much to see. Meanwhile, the Coast Guard paid him a visit to check for a license. ("It was kind of funny," he says. "At 12 feet and without a motor, the sub was actually classified as a canoe.") There was no beef as long as Stanley was merely risking his own life. But to take paying customers down,

intense ways, like they were suddenly realizing that they regretted a lot. There's something about being down there, away from everything, where nobody can reach you, that makes you philosophic."

True to his observation, it seems that simply talking about it can have the same effect on Stanley. He recounts tales both sublime and thrilling—about how he once snuck up behind a blue marlin so quietly that the fish didn't even know he was there, a few feet away, for several minutes; about how on another dive he heard it raining on the surface, 500 feet above. He describes underwater vistas that are both Wordsworthian and Dali-esque: coral landscapes stretching to a seemingly limitless horizon, limestone overhangs so pockmarked by the sea that it appears you could grind them into dust

## What if the **SUB WENT BELOW MAXIMUM DEPTH?** "It would collapse," Cheamitru said. **"IRREVERSIBLY AND CATASTROPHICALLY."**

he was going to need his submarine officially "classed" by the American Bureau of Shipping. This naturally collided with his innate libertarian ethos. Besides, the price tag was \$100,000.

And so, when someone offered him a chance to hang a shingle at a place called the Inn of Last Resort, in Roatán, Honduras, Stanley was more than happy to relocate.

**R**oatán rests upon an underwater ridge where a dramatic wall is only a short swim from shore. The dropoff north of the island descends quickly into the Cayman Trench; at nearly 25,000 feet, it's one of the world's deepest ocean trenches. Roatán is also overrun with people on dive vacations who, Stanley hoped, would enjoy seeing the ocean below scuba depths. He was right. He started taking people down as deep as 700 feet for an hour, at \$185 per ride. Soon he was doing a dive a day.

"The divers loved it," he says, "because they'd never been so deep for so long." Because *C-BUG* is pressurized, there is no danger of developing the bends. Stanley can dive to the bottom for hours at a time, shoot to the surface without any kind of safety stop, and be fine.

Almost universally, Stanley's passengers remarked that they'd never realized how silent it is underwater. Most divers are used to the constant gurgle of their regulators and have become accustomed to diving in the company of white noise. "Serious divers," he says, "tell me this is like discovering diving all over again."

Another thing Stanley noticed was that many of his passengers became existential when they got down to depth. "They all said the same thing, that this was absolutely the most beautiful place they'd ever seen," he says. "There were several times when people would start talking about their lives and the choices that they made in very

between your thumb and forefinger. When he speaks, he's dreamy, full of wonder, as if after hundreds of dives he still can't believe how fortunate he is to be able to visit such a place.

And then he gets so philosophic that he distills the appeal of the deep in a statement that could almost serve as his own personal credo. "What I love most of all about being in the sub is that you're in a place where there is zero probability of running into someone," he says. "It's a frontier, and you're totally on your own. There's no underwater Coast Guard. No air traffic controllers. No one can control you."

**L**ike many of Stanley's customers, Andy Kaufmann heard of the young guy with the yellow submarine from his dive-boat captain. Kaufmann, a 54-year-old lawyer from Reston, Virginia, was scuba diving for a week off Roatán and was looking for a way to get deeper.

After meeting Stanley, who's six feet tall and 165 pounds, Kaufmann classified him as the varsity-football type—full of energy and utterly confident. "People who are nervous tend to explain everything," says Kaufmann, "every nut and bolt, everything that will save your life if something goes wrong. All he said was 'It's going to be very cramped; I want you to get in and see how you feel. There are levers behind you—I may want you to work those, so see if you can reach them.' And that's all I needed to know at the time."

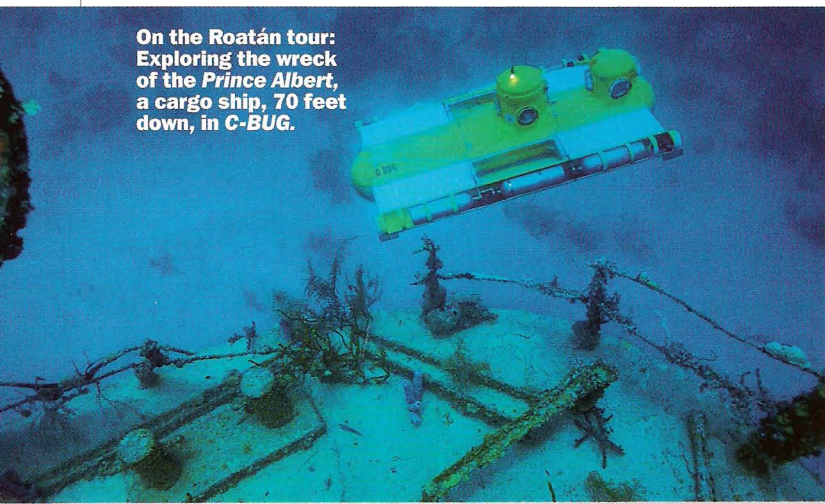
On the way down, Kaufmann was most struck by something he saw at 570 feet. The sub scraped a wall, sending up a cloud of sediment. Ten minutes later, when they circled back to the same spot, the cloud hadn't dispersed. "There was no current," Kaufmann says. "There was absolutely no current—it was amazing."

At 650 feet, Kaufmann was pivoting from porthole to porthole in the claustrophobic tower when—*crack!* It was like the sound of a .22-caliber rifle—the porthole, only inches away from his face, suddenly sprouted a diagonal fissure. "We have a crack in the window!" Kaufmann yelled. "Let's get up!"

Stanley immediately released air into the ballast tanks, and the sub jerked toward the surface. That's when water started spraying in. "It was coming in with the force of a high-power shower jet," says Kaufmann. "And he said, 'Don't worry, we can take X number of gallons,' yadda-yadda. He gave me some stat that didn't mean anything because there was water hitting me in the face. But what he was basically telling me was, we're not sinking. Then the third thing happened. Smoke."

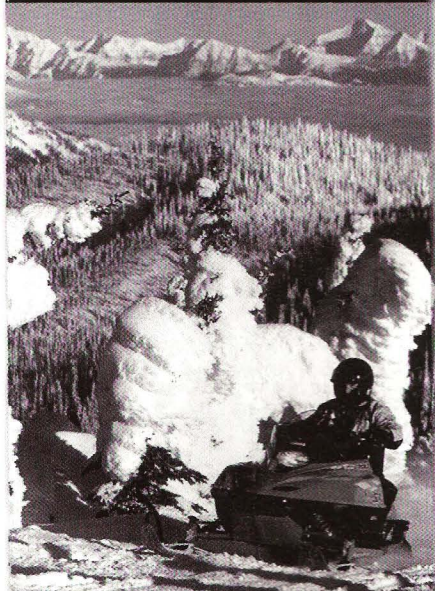
The water had shorted out an electrical (Continued on page 110)

**On the Roatán tour:**  
Exploring the wreck  
of the *Prince Albert*,  
a cargo ship, 70 feet  
down, in *C-BUG*.





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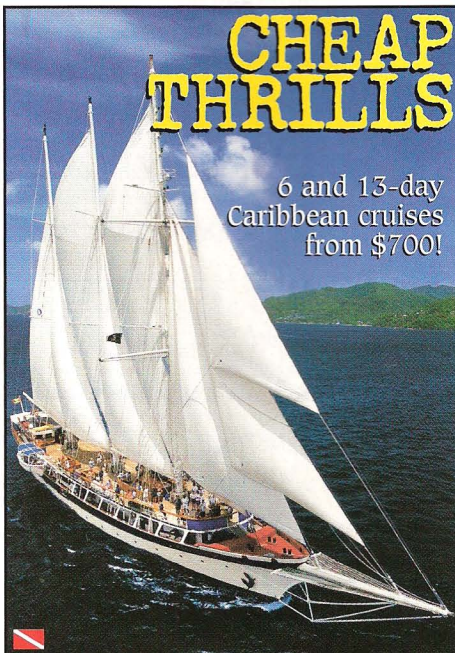
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## LITTLE SISTER

(Continued from page 109)

8,000-meter peaks. I hated the whole expedition. Climbing a big mountain, I realized, is no way to seek clarity or improve a relationship. Rather, it seems to foster confusion and indecision. It breaks up teams; it harms friendships. It was, I decided, an extraordinarily selfish pursuit.

We retreated to Camp II, fighting our way through the storm. Beth and I dove into one tent, Jamie and Pasang into another. There was nothing to do. It was brutally cold. We just lay in the tent and stared at the ceiling. We stared so long that Beth eventually took a picture of it. We were now in whiteout conditions; the mountain seemed no longer to exist—my world was reduced to a tent shaking so violently in the wind it made me seasick.

I missed Diana. With her gone, the climb seemed pointless. She was at Advance Base Camp, safe and recovering—I could speak with her on our radio—while I was fighting illness and exposed to serious avalanche danger. I don't think I'd ever felt more distant from her. It dawned on me, as I stared at the ceiling, that I hardly knew who my sister was. Athleticism was our only argot, and it was a limited one. I'd been awed by Diana's achievements, by her talents, by her physical prowess. I felt like I knew *about* her, as with a celebrity, but didn't actually know her. We'd spent nearly a month together on Cho Oyu, but there were few moments, if any, of real bonding. This made me sad. It was then, in my tent, with the wind howling, that I thought: *I would really like to get to know her.*

In the post-monsoon season of 2001, 28 of the 35 teams that attempted Cho Oyu placed at least one climber on the summit. Eighty-eight people reached the top. The Korean, Kim Su-Ya, was the only fatality. There still has never been a brother-sister team to climb an 8,000-meter peak. I waited at Camp II for three nights, until the storm finally broke and the sun reemerged. A few climbers began working their way back up the mountain, trying for the top, but I started down. I was headed all the way to Base Camp, so that I could say hello to my sister. ▲

Hear siblings Michael and Diana Finkel tell more stories about their attempt on Cho Oyu at [www.nationalgeographic.com/adventure](http://www.nationalgeographic.com/adventure). AOL Keyword: NatGeo Adventure.

## THE PIPE DREAMER

(Continued from page 96)

panel. "So we have a structural failure, we're taking on water and sinking, and we have a fire," Kaufmann says. "It was the longest five minutes of my life to the surface. And it was the most spectacular sunrise I've seen—when that sun finally came through the porthole, it felt like being reborn." Yet even after his narrow escape, Kaufmann says, he'd dive with Stanley again.

Before this mishap, Stanley had pushed his sub as deep as 725 feet. He has twice spent the night in it, once at 550 feet and then at 450 feet. The second time, he tied raw chicken and fish to the hull and listened all night in inky darkness to the sound of hammerheads and bull sharks devouring the meat. "They were getting pretty aggressive," he says. "I was nervous at one point that they'd nudge me off the ledge. It was probably a thousand feet down from there or more."

Stanley dismisses questions about the structural integrity of the craft by explaining that steel and acrylic are ideal materials for building a submarine because they give ample warning of impending failure. "Steel bends and Plexiglas cracks," he says. "They are very forgiving."

All of which is true, says Michael Cheamitru—up to a point. "The problem with your friend's trial-and-error method," says Cheamitru, an engineer who tank-tests subs for the Navy, "is that at the moment he starts seeing the steel bend, he's not very far away from some very exciting things happening."

I asked Cheamitru to run the numbers. Using the classic elastic-buckling equation, which looks at the relationship between the size of a cylinder and the thickness of its steel walls, he calculated that Stanley's sub has a breaking strength of 195 psi, which translates to a maximum depth of 440 feet. This doesn't take into consideration the steel ribs Stanley has welded to the inside of the cylinder. Cheamitru acknowledged that these would make the sub stronger.

But how much stronger?

"Listen, there's no way I'd get into that sub," he answered. "If you publish an article about it and glorify what this guy's done and then some kid goes out and tries to do something similar and dies . . . well, don't be surprised if you have a vengeful parent after you."

Instead of pointing out that such a kid would have to spend around four years welding the sub in his yard—hardly something he could do without arousing at least his parents'



## THE PIPE DREAMER

(Continued from page 110)

passing interest—I asked what would happen, according to the equation, if the sub went below the maximum depth. “It would collapse,” he said. “Irreversibly and catastrophically. Imagine a Coke can pressed evenly on all sides.” When I asked him how small it would become, Cheamitru paused. Then, quietly, he answered: “Small. Very, very small.”

After eight months in Roatán, a restless Stanley began to look for something new and discovered shell collecting, which turned out to be big business: A large, perfectly shaped slit shell can fetch up to \$2,000. A rare one can bring five times that. Scuba divers don’t often search deeper than 200 feet; in his sub, Stanley started scouring ledges at 400 and 500 feet, where undisturbed slit shells grow to the size of baseballs.

He also decided to try salvage work, connecting with a Canadian company that has partnered with the Cuban government to search for wrecks outside Havana’s harbor, a major port of call during the height of the Spanish Empire. Some historians believe that hundreds of galleons lie just offshore—dozens possibly filled with gold.

For his part, Stanley thinks that most of what sank probably tumbled down into the Florida Straits. What didn’t is likely to be so covered in silt that it will be impossible to find. “The salvage world is filled with a lot of sad people who think they’re going to make a fortune,” he says. “They picture the sub as some kind of underwater front-loader just scooping up gold coins.”

After two weeks diving in Cuba, he had found four diesel boilers, a half mile of cable, and one steel cannon just like those planted by the hundreds around Havana Vieja. “I never work on percentage,” he says. “The sub is pretty cheap to run, so I don’t charge much. But I always charge something.”

Stanley likes to have five or six unconventional plans or projects going at once. One scheme involves helping wealthy clients build their own subs. He dreams that, with \$100,000 (he estimates his sub cost close to \$18,000), he could build an experimental craft entirely of glass. A sphere with two-inch-thick walls, it would dive as deep as 10,000 feet. Another plan entails designing a subaquatic B&B, a disk-shaped pod that could be lowered a thousand feet by a cable onto an outcrop with spectacular underwater vistas. Honeymooners would be shuttled

out in a dinghy just before sunset, sealed in, and dropped. “I don’t know,” he says, “maybe we’d attach some meat to the outside just for kicks.”

Early this year, a machinist Stanley met on Roatán offered him the opportunity to rent a hangar in Oklahoma. After spending several months visiting suppliers from Long Island to New Mexico, Stanley holed himself up there to begin building a bigger, better submarine.

“This sub isn’t anything like *C-BUG*,” he says. “It’s kind of like a snowman. There are three different-sized spheres stacked in an L.” One or two passengers will sit in a forward sphere with a large curved window. Stanley will pilot the vessel from a separate sphere behind them, where he’ll be able to angle the nose—and his passengers—close to undersea walls or coral-encrusted wrecks, making for a much more visually intense experience.

“I knew I wanted a sub that could go down to 1,800 feet, since that’s where a rare and valuable species of slit shell lives,” he says. “But then I figured, once I was down that far, why not go farther?”

Specifically, he’s thinking 1,200 feet farther. Nine years ago, the U.S. Navy was forced to jettison a 300-foot cargo ship it had salvaged off Roatán. According to the ship’s log, which noted exact coordinates, it sank in about 2,300 feet of water. “The seafloor there is fairly steep,” Stanley says, “so it might be deeper. In any case, I think I can find it.” The plan is to head back to Roatán, locate the ship, and start taking tourists down.

“Three thousand feet is pretty deep,” he says. “There’s no ambient light, so the sub has to have good lights. And it’s cold, so people will have to bundle up. But I imagine some will want to go down that far, just for the thrill. It’s a big ship, sitting there in the dark, 3,000 feet below the surface. Pretty cool.”

Stanley spent the summer and fall welding the joints between the spheres and having the sub “stress-relieved,” which essentially involves baking it to remove any imperfections and weaknesses caused by the welding. He has even toyed with the idea of buying time at a test tank. “I’m pretty sure this new one will be safe down to a thousand feet or so, but it’s a little questionable beyond that,” he admits.

Stanley estimates that he’ll have his new sub in operation in Roatán by May 2003. After that, who knows? “I just sent a business plan for my underwater hotel to the tourism

minister for Roatán,” he says excitedly. “I’ve got an extra 38-inch spherical window; I’m going to put it in the honeymoon suite so that couples can look out at a thousand feet and watch a shark take bait off a hook.”

Stanley was grounded for his first five weeks in Cuba. Though the Cuban government had approved the salvage operation, it balked at the last minute and delayed his dives. The wait was interminable. At first he toured the country by motorcycle, tracing Che Guevara’s steps from Santa Fe to Santiago. But then the Cubans revoked his bike permit, and he was confined to the Marina Hemingway, 20 miles west of Havana.

He and I spent two weeks together then, drinking muddy coffee by the pool. I badgered him with questions: What would it feel like if the sub imploded? How close had he ever come to getting trapped? He shrugged them off with the nonchalance of someone who’s done something dangerous many times over. So I asked the next logical question: Is there anything he does fear?

Stanley responded by leaning forward and pulling out a folded piece of paper, dirty and worn. He opened it and showed me how it had 52 squares across and about 110 rows down. “Each Sunday I fill in a block, making my way across in an entire year,” he said, his eyebrows lifting to make sure I was following. “And then each year I move down a row.” He pointed to the top quarter of the page, which was colored in, block by block, in all manner of lead and ink.

He leaned back and crossed his arms on his chest as if he expected me to get it. I shrugged.

“I fear the idea of time slipping by,” he explained. “Every old person I talk to says that they feel like life has just flown by. But this”—he held up his little mortality gauge—“prevents that from happening. It puts your life into perspective. You’re always aware of how much time you have left.”

On the other side of the pool, a group of kids started a game of chicken, splashing water and causing a stir among the sunbathers. Stanley sipped his coffee.

“Can you imagine keeping a chart like that and having the same job for 25 years?” he asked. “It’s impossible.”

For news on the further subaquatic adventures of Karl Stanley, visit [www.nationalgeographic.com/adventure](http://www.nationalgeographic.com/adventure).